

REMARKS

The above amendments to the above-captioned application along with the following remarks are being submitted as a full and complete response to the Official Action dated May 20, 2004. In view of the above amendments and the following remarks, the Examiner is respectfully requested to give due reconsideration to this application, to indicate the allowability of the claims, and to pass this case to issue.

Status of the Claims

Claims 1-11 are under consideration in this application. Claims 1-8 are being amended, as set forth in the above marked-up presentation of the claim amendments, in order to more particularly define and distinctly claim applicants' invention. New claims 9-11 are being added to recite another embodiment described in the specification.

Additional Amendments

Claims 1-8 are being amended to correct formal errors and/or to better recite or describe the features of the present invention as claimed. All the amendments to the claims are supported by the specification. Applicants hereby submit that no new matter is being introduced into the application through the submission of this response.

Prior Art Rejections

Claims 1-8 were rejected under 35 U.S.C. § 103(a) as being unpatentable over US Pat. No. 5,969,351 to Nabeshima et al. (hereinafter "Nabeshima") in view of US Pat. App. Pub. No. 2003/0122069 of Kato (hereinafter "Kato"). The prior art reference of Bajic (6,462,336) was cited as being pertinent to the present application. These rejections have been carefully considered, but are most respectfully traversed.

The mass spectrometer 10 of the invention (e.g., Figs. 1-2), as now recited in claim 1, comprises: an atmospheric pressure chemical ionization source APCI having a primary ionization part 28 for generating a primary ion (e.g., Ar^+ ; p.15, last paragraph) by means of electric discharge of a reagent gas (e.g., Ar), a secondary ionization part 23 for generating an ion (e.g., N_2H^+ ; p. 16, last paragraph) of a sample gas (e.g., $\text{N}_2 + \text{H}_2$; p. 16, lines 17-24) by a reaction of said primary ion Ar^+ and said sample gas $\text{N}_2 + \text{H}_2$, and a hole disposed between said primary ionization part 28 and

said secondary ionization part 23 as a passage for said primary ion Ar^+ to enter from said primary ionization part 28 into said secondary ionization part 23 while said secondary ionization part 23 being maintained at negative pressure as compared with said primary ionization part 28(p. 4, line 14 – p. 5, line 3; p. 14, last paragraph; Fig. 2); a mass spectrometric part 11 for performing mass spectrometric analysis of said ion N_2H^+ generated in said secondary ionization part 23; a mixing portion 33 for mixing said sample gas to be introduced into said secondary ionization part 23 with a dilution gas (*“the dilution gas, such gas having low proton affinity as not to disturb the reaction of (Chemical Formula 3), for example, argon, helium or nitrogen”* p. 17, last paragraph); means 30 for controlling a flow rate of said dilution gas for flowing through said mixing portion 33; and means 12-1 for controlling a flow rate of said sample gas $\text{N}_2 + \text{H}_2$ for flowing through said mixing portion 33,. The mixed gas obtained by mixing said sample gas $\text{N}_2 + \text{H}_2$ with said dilution gas is introduced into said secondary ionization part 23.

The invention is also directed to a mass spectrometer, as recited in claim 6, which includes all the elements of claim 1, wherein (i) the ion of the sample gas (e.g., N_2H^+) is collected from a gas outlet piping on a cathode of a fuel cell, (ii) said means for controlling a flow rate of said sample gas is disposed at an outlet piping (e.g., 12-3 in Figs. 1-2) of said atmospheric pressure chemical ionization source, (iii) said dilution gas is any of argon, helium and nitrogen, and (iv) hydrogen in said sample gas is detected.

Accordingly, by (1) generating a primary ion (e.g., Ar^+) by electric discharge of a reagent gas (e.g., Ar)” in one space 28 then (2) generating an ion (e.g., N_2H^+) of a sample gas (e.g., $\text{N}_2 + \text{H}_2$) by a reaction of the primary ion Ar^+ and the sample gas $\text{N}_2 + \text{H}_2$ ” in another space 23 connecting to the first space via hole and at a negative pressure, the invention samples the impurity in a fuel cell *“while the fuel cell is maintained in a normal operating state without disturbing a system targeted for inspection, for example, an operating system of the fuel cell* (p. 3, line 26 to p. 4, line 1)”.

Applicants respectfully contend that none of the cited prior art references teaches or suggests such “an atmospheric pressure chemical ionization source having a primary ionization part and a secondary ionization part which are separated through a hole therebetween as a passage for said primary ion Ar^+ to enter from said primary ionization part 28 into said secondary ionization part 23 while said secondary ionization part 23 being maintained at negative pressure as compared with said primary ionization part 28, and means for controlling a flow rate of the sample gas”.

In contrast, Fig. 10 of Nabeshima as replied upon by the Examiner only depicts a liquid

chromatography/mass spectrometer apparatus LC/MS provided with a nebulization region 4, a vaporization region 108, and an ionization region 110 (col. 7, lines 12-31). Contrary to the Examiner's assertion that 36a in FIG. 10 of Nabeshima equivalent to the primary ionization part 28 of the invention, 36a in FIG. 10 only *heats* and *nebulizes* the sample solution in the nebulization region 4 (col. 7, lines 17-18; FIG. 10), rather than "*generating* a primary *ion* (e.g., Ar^+) by electric discharge of a reagent gas (e.g., Ar)" according to the invention. As to the ionization region 110, it only ionizes the sample molecules ("*The gaseous sample molecules obtained by the vaporization of the droplets are introduced into the ionization region 110 within which the needle electrode 8 is disposed. A high voltage of several kilo-volts is applied to the needle electrode 8 so as to generate a corona discharge in the ionization region 110. The sample molecules react with the ions generated by the corona discharge and are ionized*" col. 7, lines 19-25). As such, the ions generated in Fig. 10 of Nabeshima are only related to the sample (col. 7, 25-27), but not any reagent gas. Moreover, these ions are generated in the same corona discharge space, rather than in two different space while the second space connecting to the first space via hole and at a negative pressure.

Other embodiments of Nabeshima (e.g., Figs. 2, 8) also primarily *ionize* the sample molecules/solution in a corona discharge space in the vicinity of a needle electrode 8 and secondarily *ionize* the sample molecules/solution in the same space by the ion-molecule reaction (col. 5, lines 24-33; FIG. 2), rather than primarily ionizing a reagent gas in one space then secondarily ionizing a sample gas in another space according to the invention. The pumping system 12 between the first electrode 11 and the second electrode 11 only accelerate ions 9 into the vacuum region through an ion intake orifice opening, but not ionize anything therein (col. 5, lines 56-66).

Moreover, Nabeshima does not teach means for controlling a flow rate of the sample gas. Much less does Nabeshima teach that such means for controlling a flow rate of the sample gas is disposed at an outlet piping (e.g., 12-3 in Figs. 1-2) of the atmospheric pressure chemical ionization source.

Kato fails to compensate for Nabeshima's deficiencies as described above. In addition, Kato was relied upon by the Examiner to teach a mixing portion. However, Kato's dry nitrogen gas in the alleged mixing portion is not a dilution gas for mixing a sample gas therewith, but merely emitted into the vacuum chamber together with sample ions to dilute the sample ions ("*The nitrogen gas will dilute the ions generated during spraying, up to 100 to 100,000 times*

within the fine tube” [0008]). Kato has an atmospheric pressure ion source 4 and a vacuum chamber 12 connected through a first fine tube 8 and a second fine tube 10. One end 40 of the second fine tube 10 projects into the atmosphere 7 in the atmospheric pressure ion source 4. The second fine tube 10 can suck the gas and ions 6 sprayed from the spray probe 3, and a dry nitrogen gas 9 passes through the space between the first fine tube 8 and the second fine tube 10, and is emitted into the vacuum chamber 12 (paragraphs [0021], [0052] to [0058]; Figs. 1-2).

Accordingly, Applicants contend that the suggested combination does not embody each and every feature of the present invention as now claimed in claims 1 and 6 from which claims 2-5 and 7-11 depend. The difference is more than sufficient that the present invention as now claimed would not have been rendered obvious given the prior art. Rather, the present invention as a whole is distinguishable, and thereby allowable over the prior art.

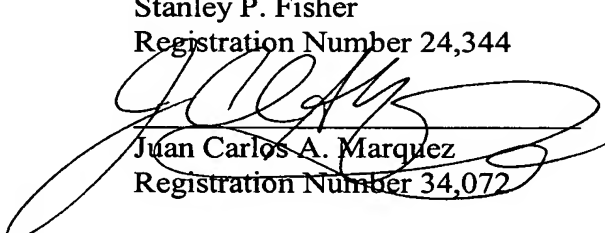
Conclusion

In view of all the above, clear and distinct differences as discussed exist between the present invention as now claimed and the prior art reference upon which the rejections in the Office Action rely, Applicants respectfully contend that the prior art references cannot anticipate the present invention or render the present invention obvious. Rather, the present invention as a whole is distinguishable, and thereby allowable over the prior art.

Favorable reconsideration of this application is respectfully solicited. Should there be any outstanding issues requiring discussion that would further the prosecution and allowance of the above-captioned application, the Examiner is invited to contact the Applicants' undersigned representative at the address and phone number indicated below.

Respectfully submitted,

Stanley P. Fisher
Registration Number 24,344



Juan Carlos A. Marquez
Registration Number 34,072

REED SMITH LLP
3110 Fairview Park Drive, Suite 1400
Falls Church, Virginia 22042
(703) 641-4200
September 10, 2004
SPF/JCM/JT